

MOLECULAR PROCESSES IN COMETS

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For the period 1 January through 30 June, 1988

Principal Investigator

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The transition dipole moments of the $c^3\Pi_u - a^3\Sigma_g^+$, $i^3\Pi_g - c^3\Pi_u$ and $i^3\Pi_g - b^3\Sigma_u^+$ transitions of molecular hydrogen have been calculated over a wide range of internuclear distances R . Table 1 lists the values in atomic units.

Calculations of the emission spectra are nearing completion.

Substantial progress has been made in the calculation of the absorption coefficient of a colliding pair of hydrogen atoms in the binary encounter approximation.

I also participated in a study by my graduate student, collaborating with E.F. van Dishoeck, of the processes affecting the emission of C_2 in comets. A paper is in preparation. It forms part of the thesis of Dr. Roland Gredel.

Detailed calculations have been performed of the continuum emission arising from the excitation of the $a^3\Sigma_g^+$ state of H_2 by the impact of electrons of various energies. The set of figures show the resulting spectra. Each curve is labelled by the electron energy in electron volts. The strong emission near Lyman α is interesting in that it is produced by excitation of molecular hydrogen.

Table 1

D(R)

R (a_0)	c-i	b-i	a-c
0.50	1.854	1.680	2.601
0.75	1.837	1.453	2.627
1.0	1.831	1.174	2.649
1.1	1.832	1.063	2.656
1.25	1.838	0.9072	2.667
1.3	1.841	0.8603	2.670
1.4	1.848	0.7752	2.677
1.5	1.857	0.7023	2.684
1.7	1.880	0.5907	2.698
1.9	1.908	0.5164	2.712
2.0	1.924	0.4901	2.719
2.1	1.940	0.4694	2.726
2.3	1.973	0.4422	2.740
2.5	2.007	0.4301	2.753
2.7	2.038	0.4305	2.765
2.9	2.062	0.4424	2.776
3.2	2.075	0.4828	2.787
3.5	2.032	0.5555	2.793
4.0	1.685	0.7582	2.781
4.5	0.9642	0.9503	2.735
5.0	0.4137	1.020	2.646
6.0	0.0327	1.042	2.397
7.0	0.0212	1.044	2.174
8.0	0.0152	1.046	1.979
9.0	0.0061	1.048	1.745
10.0	0.0011	1.050	1.420
15.0	0.0011	1.053	0.0516
20.0	0.0003	1.053	0.0227
100.0	0.0000	1.054	0.0000











